CLAIMS

1. Die apparatus having an axis and extending between a die entrance and a die exit, and configured to form corrugated pipe from thermoplastic material in association with transported wall mold sets, defining a wall forming tunnel comprising:

an outer wall forming treatment assembly including an outer wall homogenizing assembly configured to receive a said material and having an annular outer wall homogenizing exit through which said material is expressible;

an annular delivery channel spaced from and extending along said die axis having an outwardly disposed surface, configured in material transfer relationship with said outer wall homogenizer exit and extending a reservoir distance to an annular outer wall nozzle through which said material is expressible into wall profile defining relationship with said mold sets;

an extender conduit having an input configured for receiving a said material under pressure, having a surface extending in spaced relationship from said annular delivery chamber to a feed outlet on the vicinity of said outer wall annular nozzle and disposed generally about said axis;

an outer wall forming treatment assembly including an inner wall homogenizer assembly configured to receive a said material from said extender conduit feed outlet and having an annular inner wall homogenizer exit through which said material is expressible and in material transfer relationship with an annular inner wall nozzle located axially downstream from said outer wall annular nozzle through which said material is expressible to engage an inner surface of inwardly depending valleys of the outer wall material formed within said forming tunnel defining mold sets.

2. The die apparatus of claim 1 in which:

said outer wall homogenizer assembly includes an outer wall cutting assembly having an input assembly for receiving said material and spaced radially disposed outer wall distribution paths of given radial pattern having outer wall path outlets, and an outer wall spiral channel assembly having inputs in material flow relationship with said outer wall path outlets and extending to define said outer wall homogenizer exit;

said inner wall homogenizer assembly is located axially downstream from said outer wall homogenizer assembly to define a generally enclosed space

with said annular delivery channel and includes an inner wall cutting assembly having an input assembly coupled in material transfer relationship with said extender conduit feed outlet and having spaced radially disposed inner wall distribution paths one or more of which is radially aligned with one or more of said outer wall distribution paths to define axially aligned outer wall and inner wall communication regions, said inner wall distribution paths extending to inner wall path outlets, and an inner wall spiral channel assembly having inputs in material flow relationship with said inner wall path outlets and extending to define said inner wall homogenizer exit.

3. The die apparatus of claim 2 in which:

one or more mutually axially aligned said outer wall and inner wall communication regions are respectively configured with mutually axially aligned outer wall and inner wall communication ports.

4. The die apparatus of claim 3 further comprising:

one or more communications conduits extending between said outer wall and said inner wall communication ports.

5. The die apparatus of claim 4 in which:

one or more said communications conduits extend between said die entrance and said die exit.

6. The die apparatus of claim 2 in which:

the generally annular shaped region between said outer wall nozzle and said inner wall nozzle is configured with one or more access ports communicable with said generally enclosed space.

7. Die apparatus having an axis and extending between a die entrance and a die exit and configured for forming corrugated pipe from thermoplastic material in association with transported wall mold sets defining a wall forming tunnel, comprising:

an outer wall forming treatment assembly adjacent said die entrance including a first homogenizer assembly having a first input configured to receive a

said material under pressure and having an annular outer wall homogenizer exit disposed about said axis through which a said material is expressible;

a first delivery channel spaced from and extending along said axis, having an outwardly disposed surface, configured in material transfer relationship with said outer wall homogenizer exit and extending to an annular radially outwardly disposed first and second die lip defining outer wall nozzle through which said material is expressible into wall profile defining relationship with said mold sets;

an extender conduit having an input adjacent said die entrance configured for receiving a said material under pressure, having an extender surface, extending generally within and spaced from said first delivery chamber to a feed outlet;

an inner wall forming treatment assembly including a second homogenizer assembly configured to receive a said material from said feed outlet and having an annular inner wall homogenizer exit disposed about said axis through which said material is expressible;

a second delivery channel spaced from and extending along said axis, configured to receive said material from said inner wall homogenizer exit and extending to an annular, radially outwardly disposed third and fourth die lip defining inner wall nozzle through which said material is expressible to engage an inner surface of the outer wall material formed within said wall forming tunnel defining mold sets;

a first heater assembly having one or more heater components in thermal transfer relationship with said first delivery chamber outwardly disposed surface; and

a second heater assembly having one or more heater components in thermal transfer relationship with said extender conduit extender surface.

8. The die apparatus of claim 7 in which:

said inner wall forming treatment assembly is axially spaced downstream from said outer wall forming treatment assembly to define a generally enclosed space with said first delivery channel within which said extender conduit is located, said enclosed space being effective to provide a radiative thermal transfer to said material within said first delivery channel.

9. The die apparatus of claim 8 in which:

said outer wall treatment assembly and said inner wall treatment assembly are configured having a plurality of mutually axially aligned access ports configured to receive and support axially disposed access conduits communicable between said die entrance and said die exit.

10. The die apparatus of claim 7 in which:

said inner wall forming treatment assembly and said second delivery channel are located axially forwardly from said outer wall nozzle to define an access region; and

said inner wall treatment assembly is configured with one or more access ports communicable between said access region and said enclosed space.

11. The die apparatus of claim 10 further comprising:

a generally semi-cylindrically shaped shield removably mounted over the vertically upwardly disposed portion of said access region.

12. The die apparatus of claim 7 in which:

said outer wall treatment assembly is configured to receive a first said material, and said inner wall treatment assembly is configured to receive a second said material; and

said first material having a formulation different than said second material.

13. The die apparatus of claim 7 further comprising:

an input manifold coupled with said outer wall forming treatment assembly, having a first input port configured to receive a said material under pressure from a first extruding source and effect its flow along a first path to said extender conduit input, and having a second input port configured to receive a said material under pressure from a second extruding source and effect its flow along a second path to said first homogenizer first input.

14. The die apparatus of claim 13 in which:

said input manifold second path is disposed outwardly from said first path and is configured as a preliminary material cutting assembly.

15. The die apparatus of claim 10 in which:

said second homogenizer assembly is configured having a radially outwardly disposed surface situate at said access region;

said second heater assembly has one or more said heater components in thermal transfer relationship with said second homogenizer assembly outwardly disposed surface; and

said second heater assembly is configured with electrical leads extending to said one or more heater components at said homogenizer assembly outwardly disposed surface from said enclosed space and through one or more said access ports.

16. The die apparatus of claim 10 in which:

said second delivery chamber third die lip is configured having an outer surface located at said access region;

said second heater assembly has one or more said heater components in thermal transfer relationship with said third die lip outer surface; and

said second heater assembly is configured with electrical leads extending to said one or more heater components at said third die lip outer surface from said enclosed space and through one or more said access ports.

17. The die apparatus of claim 10 in which:

said first delivery channel second die lip is configured having an outer surface located at said access region;

said second heater assembly has one or more said heater components in thermal transfer relationship with said second die lip outer surface; and

said second heater assembly is configured with electrical leads extending to said one or more heater components at said second die lip outer surface from said enclosed space and through one or more said access ports.

18. The die apparatus of claim 7 in which:

said second heater assembly has a plurality of said heater components axially disposed in a sequence along said extender conduit extender surface, and is configured having two or more heater energizing electrical networks, each electrically dedicated to a corresponding unique two or more said heater components disposed along said extender surface.

19. The die apparatus of claim 7 further comprising:

a cylindrically shaped cooling sleeve disposed about said axis, having an outer cooling surface engagable in slidable cooling relationship with material expressed from said inner wall nozzle, supported from an annulus shaped inward support ring having a plurality of spaced apart rearwardly extending abutment tabs each having an abutting surface abuttably engaging a surface of said second delivery chamber inner wall nozzle fourth die lip, said abutment tabs being of number and abutting surface area effective to minimize heat transfer from said inner wall nozzle to said cooling sleeve.

20. The die apparatus of claim 19 further comprising:

a thermally insulative pad configured in correspondence with said abutment tab abutting surface and disposed between said abutting surface and said surface of said second delivery chamber inner wall nozzle fourth die lip.

21. The die apparatus of claim 8 in which:

said extender conduit is supported by a first flange coupled within said enclosed space with said outer wall treatment assembly and by a second flange coupled within said enclosed space with said inner wall treatment assembly; and

said second heater assembly has one or more said heater components in thermal transfer relationship with said first flange and said second flange.

22. Die apparatus having an axis extending between a die entrance and a die exit and configured for forming corrugated pipe from thermoplastic material in association with transported wall mold sets defining a wall forming tunnel, comprising:

a wall forming treatment assembly adjacent said die entrance including a homogenizer assembly with an annular homogenizer exit disposed about said axis through which a said material is expressible;

a delivery channel spaced from and extending along said axis, configured with outer and inner walls spaced apart a radial distance to define a channel of annular cross section, said chamber having an entrance in material flow communication with said homogenizer exit and extending to a radially outwardly disposed extrusion nozzle configured with a first die lip extending from said outer wall to an annular first lip edge and a forwardly disposed second die lip extending from said inner wall to an annular second lip edge spaced a lip distance from said first lip edge to define an annular lip opening through which said material may be expressed; and

a control ring having an annulus shape mounted normally to said axis through a said delivery channel wall, having a radially disposed annular edge region extensible within said defined channel and radially adjustable with respect to said axis to alter said channel annular cross section an amount effective to provide a substantially uniform flow of said material about said delivery chamber into said extrusion nozzle.

23. The die apparatus of claim 22 further comprising:

a ring-shaped support member extending about said control ring and incorporating radially disposed screw members having tips extending therethrough to freely abutting contact with a radially disposed surface of said control ring and being manipulatable to alter said channel annular cross section.

24. The die apparatus of claim 22 further comprising:

a ring-shaped support member extending over a portion of said first die lip and incorporating radially disposed concentricity screw members having tips extending therethrough to freely abutting contact with said portion of said first die lip and being manipulatable to radially maneuver said first die lip toward concentricity with said second die lip.

25. The die apparatus of claim 22 in which:

said second die lip is supported from said delivery channel inner wall; and

further comprising a ring-shaped wall support member fixed to said delivery channel inner wall and configured with a plurality of radially outwardly disposed spaced apart stand-off components extending within said delivery channel into supportive freely abutting contact with the radially inwardly disposed surface of said delivery channel outer wall.

26. The die apparatus of claim 22 further comprising:

an inner wall delivery channel spaced from and extending along said axis downstream from said extrusion nozzle second die lip, configured with liner outer and inner walls spaced apart a radial distance to define a liner channel of annular cross section, said channel carrying a said material under pressure and extending to a radially outwardly disposed liner extrusion nozzle configured with a third die lip extending from said liner outer wall to an annular third lip edge and a forwardly disposed fourth die lip extending from said liner inner wall to an annular fourth lip edge.

a liner control ring having an annulus shape mounted normally to said axis through a said liner wall having a radially disposed annular edge region extensible within said defined liner chamber and radially adjustable with respect to said axis to alter said liner channel cross section an amount effective to provide a substantially uniform flow of said material about said liner chamber into said liner extrusion nozzle.

27. The die apparatus of claim 26 further comprising:

a ring-shaped liner support member extending about said liner control ring and incorporating radially disposed screw members having tips extending therethrough to freely abutting contact with a radially disposed surface of said liner control ring and being manipulatable to alter said liner channel cross section.

28. The die apparatus of claim 26 further comprising:

a ring-shaped liner support member extending over a portion of said third die lip and incorporating radially disposed concentricity screw members having tips extending therethrough to freely abutting contact with said portion of said third

die lip and being manipulatable to radially maneuver said third die lip toward concentricity with said fourth die lip.